ANSWERS: Crystal Ball questions on making salts

1) a) $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$

b) - error with chemical formula

copper oxide is not CuO_2 but CuO because copper oxide is made up of the ions, one Cu^{2+} ion : one O^{2-} ion

- error with the word equation

acid + base → salt + water

There is no CO_2 nor H_2 gas produced

- error with the salt formed

zinc sulfate cannot form from copper oxide and sulfuric acid, the correct salt formed is $CuSO_4$

- Finally, the correct chemical formulas are

CuO and H_2SO_4 and $CuSO_4$ and H_2O

So, with the same number of reactant atoms as products, the fully balanced chemical equation is

$$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$$

2) The word and balanced equations for the formation of zinc sulfate can be

zinc oxide + sulfuric acid → zinc sulfate + water

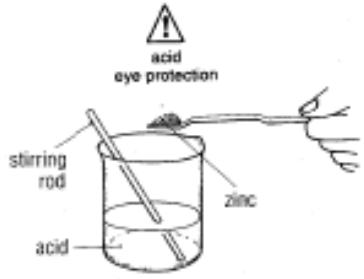
$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$

or

zinc hydroxide + sulfuric acid → zinc sulfate + water

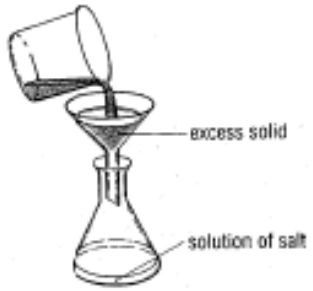
$Zn(OH)_2 + H_2SO_4 \rightarrow ZnSO_4 + 2H_2O$

1 Put about 25 cm^3 of dilute sulphuric acid in a small beaker.



2 Add zinc powder, one spatula measure at a time until no more dissolves.Stir the mixture with a glass rod to help the zinc to dissolve.

3 Filter the mixture. Collect the **filtrate** in a conical flask.
The filtrate is zinc sulphate solution.
What do you think the **residue** is?



4 Put the filtrate in an evaporating basin. Carefully evaporate the filtrate to half its original volume. (Heat gently to stop the solution from spitting.)

5 Leave the basin to cool.
The crystals of zinc sulphate should form slowly.

What do your crystals look like?

3) Carbonic acid (H_2CO_3) is an acid, it will react with limestone/calcium carbonate ($CaCO_3$) which is a base

acid + base → salt + water

Because the base is a carbonate, carbon dioxide will also be produced.

The limestone will dissolve so formations such as stalactites and stalagmites may become shorter in length or dissolve altogether. Some caves may also be formed as has been the case at Waitomo Caves.

The word equation for the reaction will be
carbonic acid (or hydrogen carbonate) + calcium carbonate → a calcium salt + water + carbon dioxide

4) The reaction between hydrochloric acid and calcium carbonate is a neutralisation reaction.

The word equation for the reaction is
hydrochloric acid + calcium carbonate → calcium chloride + water + carbon dioxide

The balanced chemical equation is
$HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$

Bubbles will be visible as carbon dioxide gas is produced. To prove that carbon dioxide gas is produced the gas can be bubbled into limewater and the limewater will turn from colourless to a milky/cloudy colour.

Water will also be produced, the test for water is blue cobalt chloride paper will turn a pink colour.

The reason that a chloride salt is formed is because the acid used was hydrochloric acid, if sulfuric acid was used a sulfate would have formed, nitric acid would have formed a nitrate.